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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,838	10/08/2004	Pei-Yu Chou	13869-US-PA	5837

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JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE
7 FLOOR-1, NO. 100
ROOSEVELT ROAD, SECTION 2
TAIPEI, 100
TAIWAN

EXAMINER

CHEN, ERIC BRICE

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 07/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,838

Applicant(s)

CHOU, PEI-YU

Examiner

Eric B. Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 October 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Priority

1. Applicant is advised of possible benefits under 35 U.S.C. 119(a)-(d), wherein an application for patent filed in the United States may be entitled to the benefit of the filing date of a prior application filed in a foreign country.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-2 and 4-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al. (U.S. Patent No. 6,692,903).
4. As to claim 1, Chen discloses an etching process, comprising: providing a material layer having a bottom anti-reflection coating (BARC) (50) (column 4, lines 1-2) and a patterned photoresist layer (60) (column 4, lines 4-7) thereon (Figure 1A); etching the BARC (50) using the patterned photoresist (60) layer as a mask (column 6, lines 19-22), wherein polymer as an etching by-product is formed on the patterned photoresist layer (column 4, lines 31-37); performing a cleaning step to remove the polymer from the patterned photoresist layer (column 7, lines 55-67); and etching the material layer (45) using the patterned photoresist layer as a mask (column 6, lines 19-22).

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5. As to claim 2, Chen discloses that the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer (column 7, lines 55-60).
6. As to claim 4, Chen discloses that the material layer (45) comprises a polysilicon layer (column 3, lines 34-43).
7. As to claim 5, Chen discloses that the ionized gas contains fluorine ions, oxygen ions, or a combination thereof (column 7, lines 63-67).
8. As to claim 6, Chen discloses that the BARC (50) comprises an inorganic material (column 4, lines 1-2).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 8-10 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Mui et al. (U.S. Patent Appl. Pub. No. 2003/0228532).
11. As to claim 8, Chen does not expressly disclose trimming the patterned photoresist layer after the material layer is provided. However, Mui teaches that the optical limitations to the lithographic process may not allow the transfer of a feature to photoresist, if the feature is smaller than the optical resolution of the lithographic process (paragraph 0008). To overcome optical limitations, dimensions of features can

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be further reduced by photoresist trimming (paragraph 0009). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to trim the patterned photoresist layer. One who is skilled in the art would be motivated to overcome the limitations of optical resolution to achieve smaller dimensions by photoresist trimming.

12. As to claim 9, Chen discloses a patterning process, comprising: sequentially forming a bottom anti-reflection coating (BARC) (50) (column 4, lines 1-2) and a photoresist layer (60) (column 4, lines 4-7) on a material layer (Figure 1A); performing a lithography process to pattern the photoresist layer (60) (column 4, lines 4-7); etching the BARC (50) using the patterned photoresist layer (60) as a mask, wherein polymer as an etching by-product is formed on the patterned photoresist layer (column 4, lines 31-37); performing a cleaning step to remove the polymer from the patterned photoresist layer (column 7, lines 55-67); and etching the material layer (45) using the patterned photoresist layer as a mask (column 6, lines 19-22), wherein the step of etching the BARC, the cleaning step and the step of etching the material layer are performed in-situ (column 4, lines 50-62; column 6, lines 52-65).

13. Chen does not expressly disclose trimming the patterned photoresist layer. However, Mui teaches that the optical limitations to the lithographic process may not allow the transfer of a feature to photoresist, if the feature is smaller than the optical resolution of the lithographic process (paragraph 0008). To overcome optical limitations, dimensions of features can be further reduced by photoresist trimming (paragraph 0009). Therefore, it would have been obvious to one of ordinary skill in the

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art at the time the invention was made to trim the patterned photoresist layer. One who is skilled in the art would be motivated to overcome the limitations of optical resolution to achieve smaller dimensions by photoresist trimming.

14. As to claim 10, Chen discloses that the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer (column 7, lines 55-60).

15. As to claim 12, Chen discloses that the material layer (45) comprises a polysilicon layer (column 3, lines 34-43).

16. As to claim 13, Chen discloses that the ionized gas contains fluorine ions, oxygen ions, or a combination thereof (column 7, lines 63-67).

17. As to claim 14, Chen discloses that the BARC (50) comprises an inorganic material (column 4, lines 1-2).

18. Claims 3 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, Lattice Press (1986) ("Wolf I").

19. As to claims 3 and 11, Chen does not expressly disclose that the ionized gas has a higher etching rate to the polymer than to the material layer. Wolf I teaches that both the mask material and underlying material are subjected to etchant attack during etching (page 523). Moreover, Wolf I teaches that selectivity of the etch process is an important characteristic to the etch process (page 523). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select an ionized gas with a higher etching rate to the polymer than to the material layer. One

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who is skilled in the art would select a selectivity targeted for the removal of the desired film.

20. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002) ("Wolf IV").

21. As to claims 7 and 15, Chen does not expressly disclose that the BARC comprises an organic material. However, Wolf IV teaches that the application of organic BARCs have the advantages of low cost, refractive index reproducibility, planarization capability, film thickness tolerance, rework capability, and surface control (page 248). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an organic BARC. One who is skilled in the art would be motivated to use an organic BARC, due to its many advantages.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Bersin et al. (U.S. Patent No. 5,882,489) discloses a method for removing photoresist residue. Nallan et al. (U.S. Patent No. 6,322,714) discloses a cleaning gas composition containing oxygen and fluorine. Kropewnicki et al. (U.S. Patent No. 6,440,864) discloses a substrate cleaning method for the removal of etching residue. Yin et al. (U.S. Patent No. 6,541,843) discloses a method of removing etching residue from a structure containing an ARC layer.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC

June 24, 2005

EBC

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

